Extended no-scale and α'^2 corrections to the IIB action

[arXiv: 1306.1237]

Francisco Gil Pedro

DESY

in collaboration with:
Markus Rummel and Alexander Westphal

Outline:

- Motivation
- Kahler moduli stabilisation
- Extended no-scale
- New α'^2 correction
- KKLT&LVS stability
- Summary

Motivation:

String theory as a unifying framework for GR and SM

Extended spacetimes: D=10,11,12

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Realistic phenomenology requires
moduli stabilisation

Leading Order

[GKP:2001]

Theory determined by Kahler potential and superpotential

$$K_{tree} = K(T) + K(S) + K(U) \qquad W_{tree} = W(S, U)$$

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Kahler moduli are flat directions

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$V_{(0,0)} \downarrow 0$ no-scale cancellation

$\downarrow$ stabilise moduli

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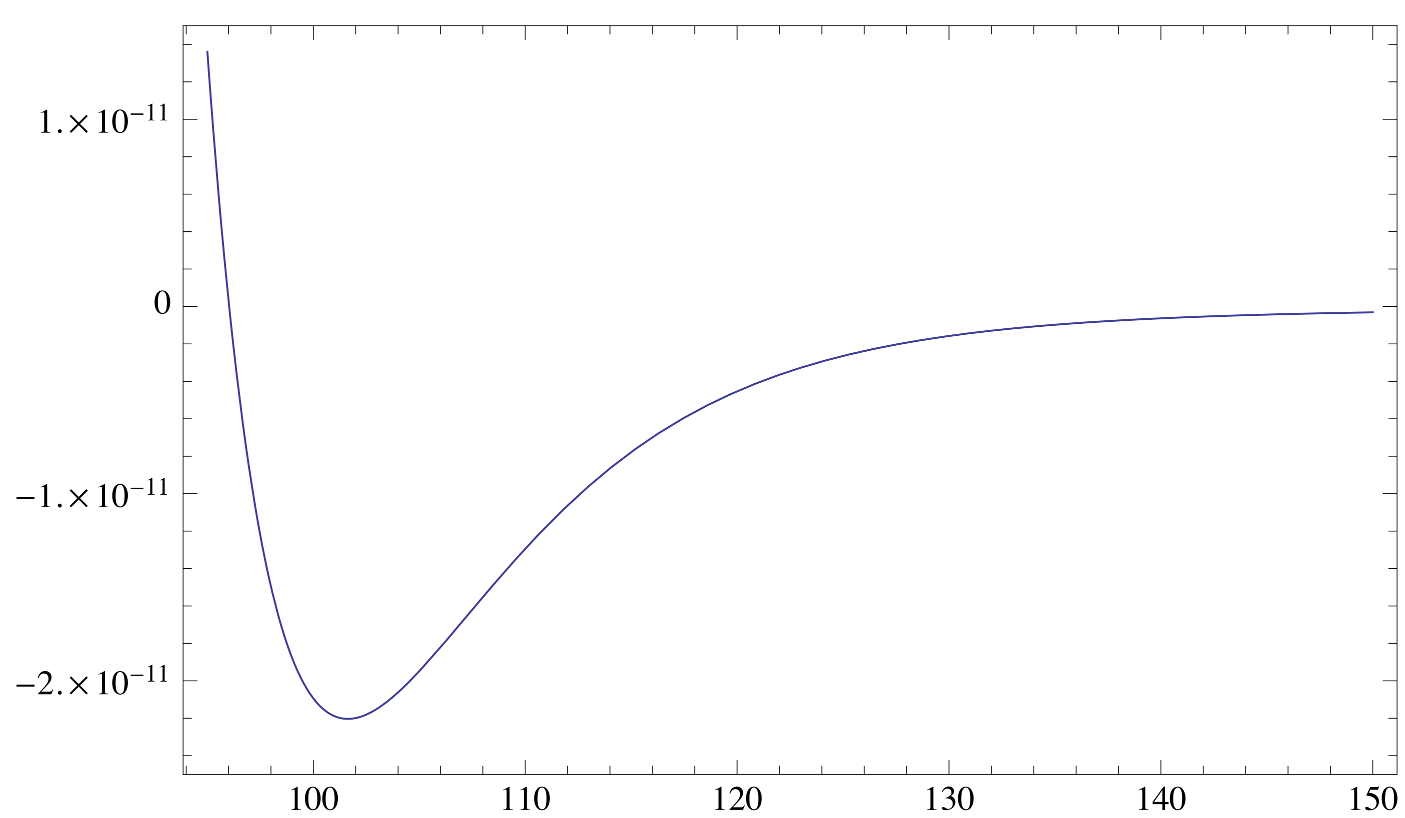

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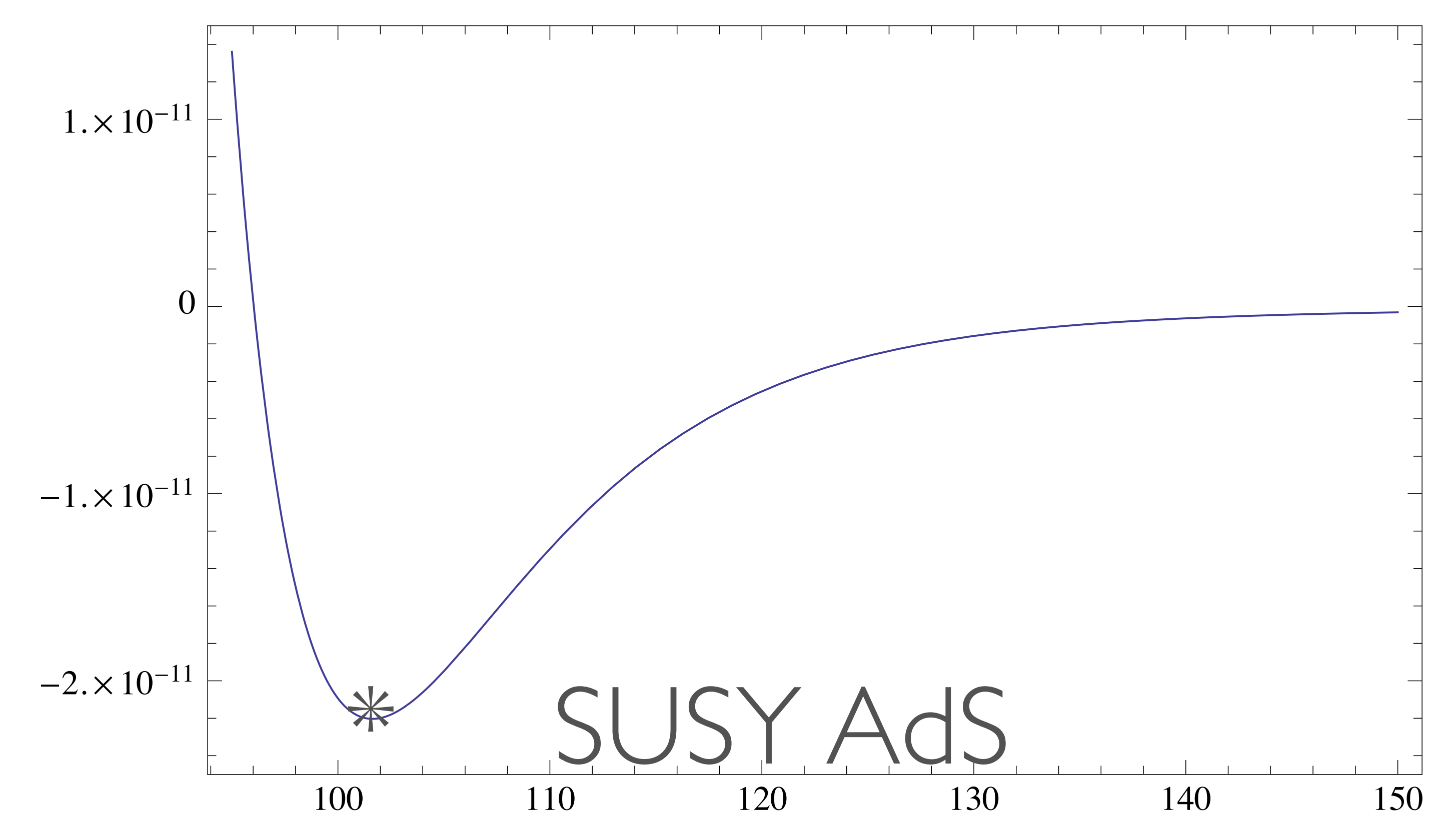
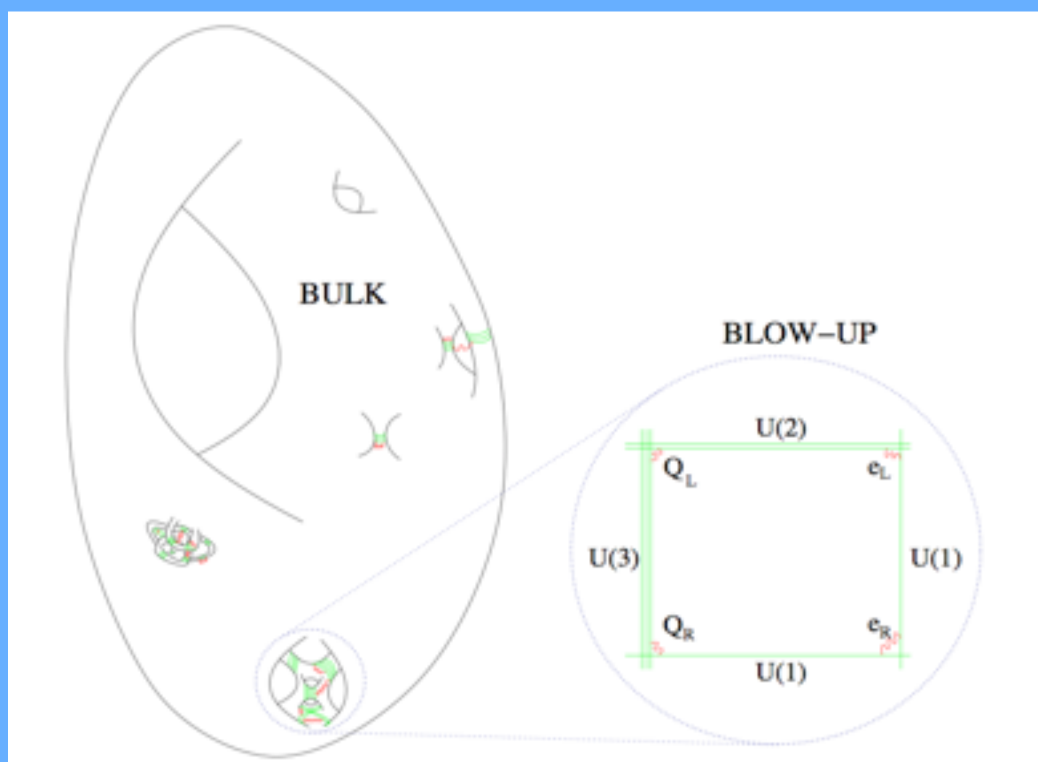


Large Volume Scenario

[BBCQ:2005]

Volume: $\mathcal{V} \sim \tau_b^{3/2} - \tau_s^{3/2}$



Let

$$\delta K = -\frac{\hat{\xi}}{\mathcal{V}}$$

$$\delta W = A\ e^{-a\tau_s}$$

$$V_{LVS} \sim \frac{a^2 A^2 e^{-2a\tau_2}\sqrt{\tau_2}}{\mathcal{V}} - \frac{aAe^{-a\tau_2}W_0\tau_2}{\mathcal{V}^2} + \frac{W_0^2\hat{\xi}}{\mathcal{V}^3}$$

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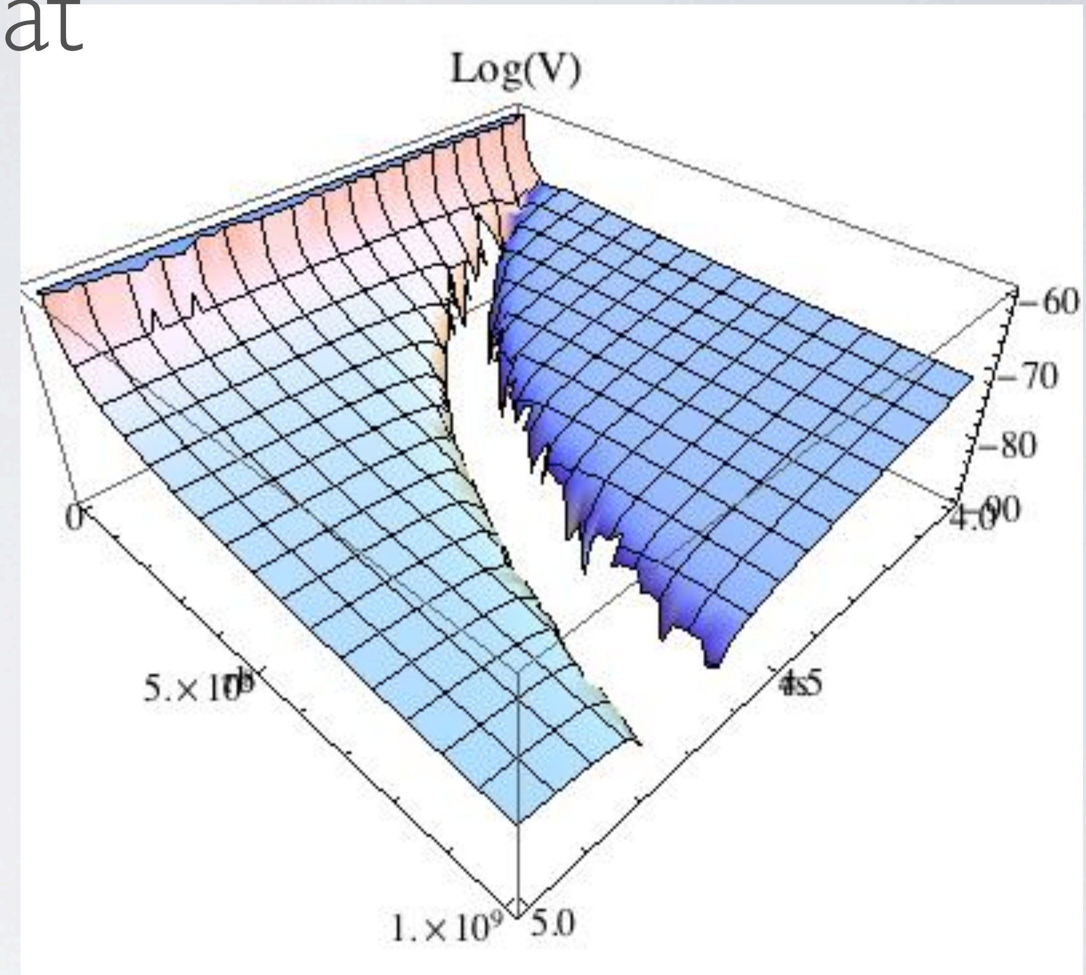
AdS minimum with broken SUSY at

$$\langle \mathcal{V} \rangle \propto e^{1/g_s} \qquad \langle \tau_s \rangle \propto \frac{1}{g_s}$$



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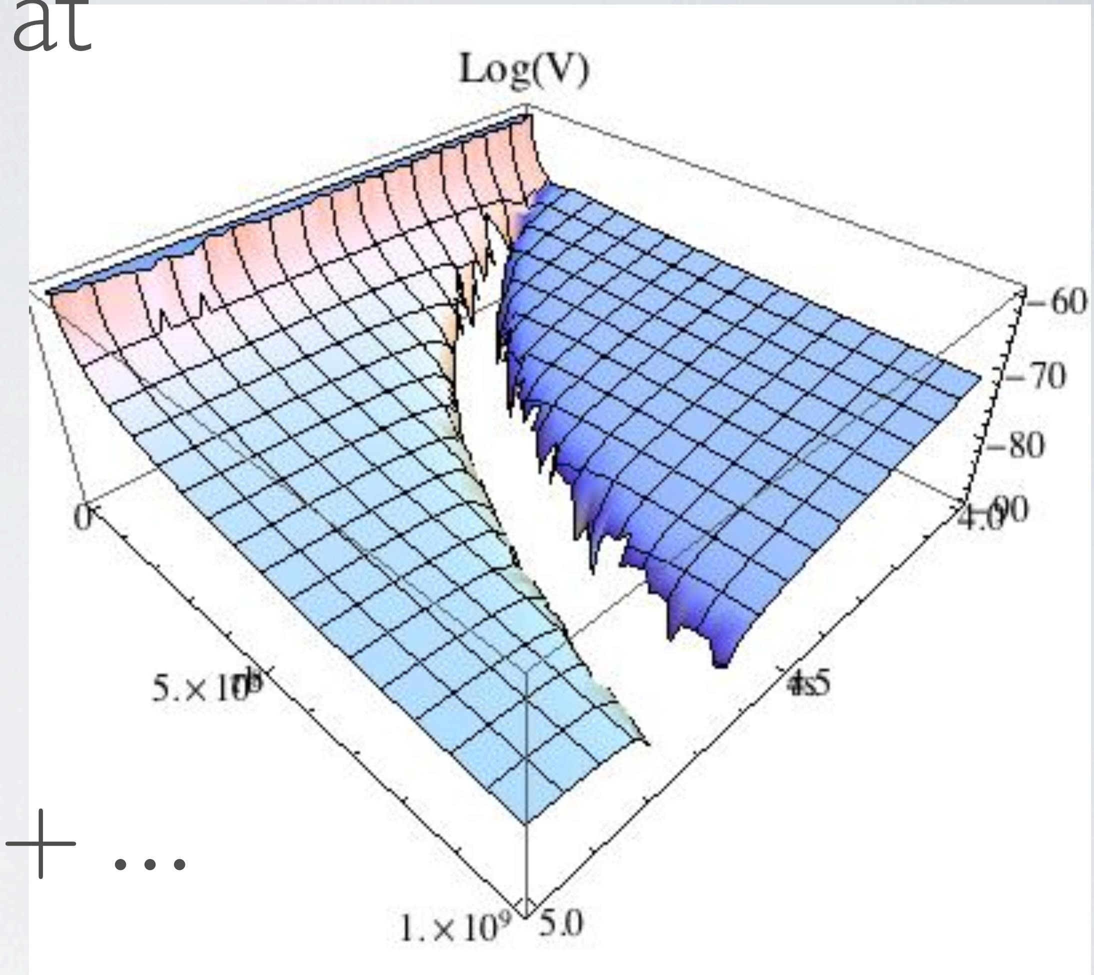

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In principle

$$\delta K = \ldots + \frac{\hat{\xi}}{\mathcal{V}} + \ldots$$

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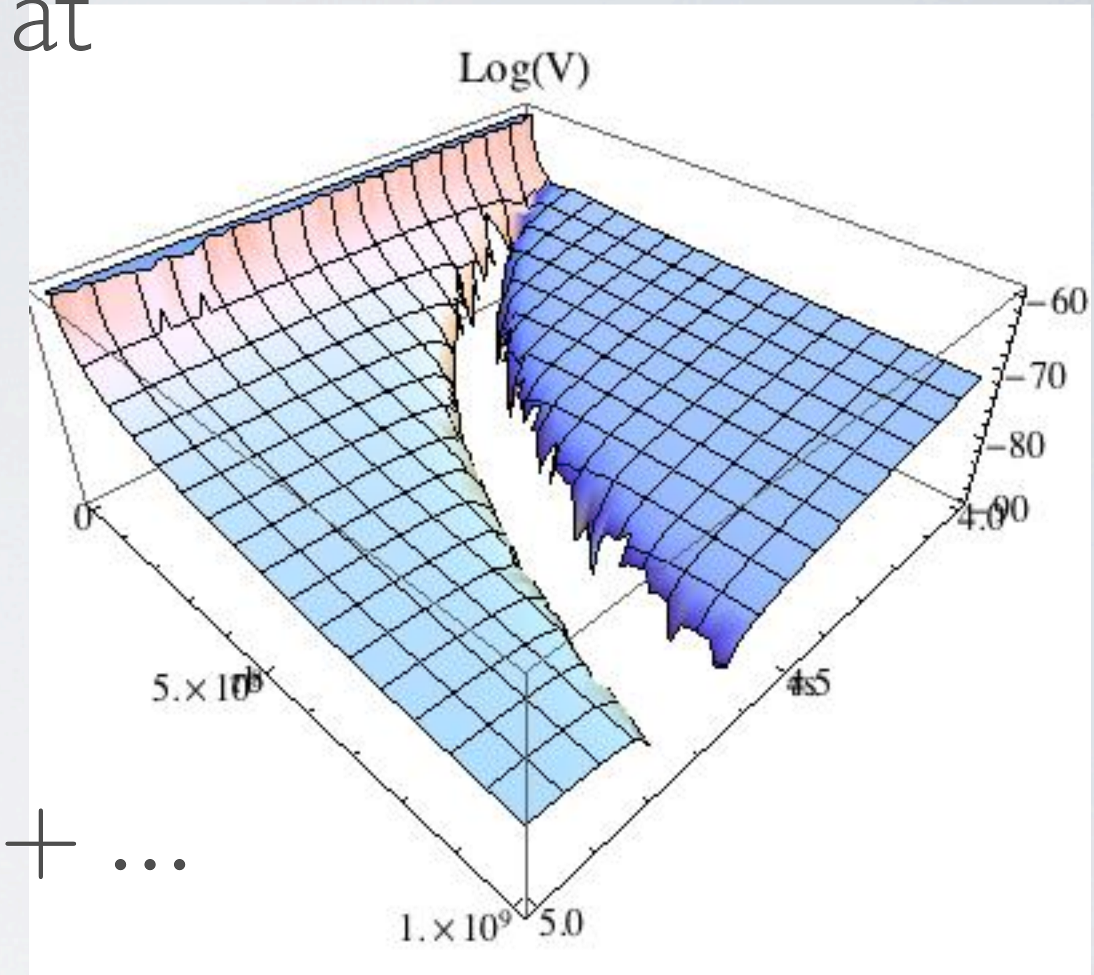

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How will other terms in K affect moduli stabilisation?

Extended No-Scale

[von Gersdorff&Hebecker,2005]
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[Cicoli,Conlon&Quevedo,2007/08]

$$K = K_0 + \delta K$$

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☑ String loop corrections

New Tree Level $g_s \alpha'^2$ effect

[Grimm,Savelli&Weissenbacher:2013]

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Effect on moduli stabilisation?

DESY

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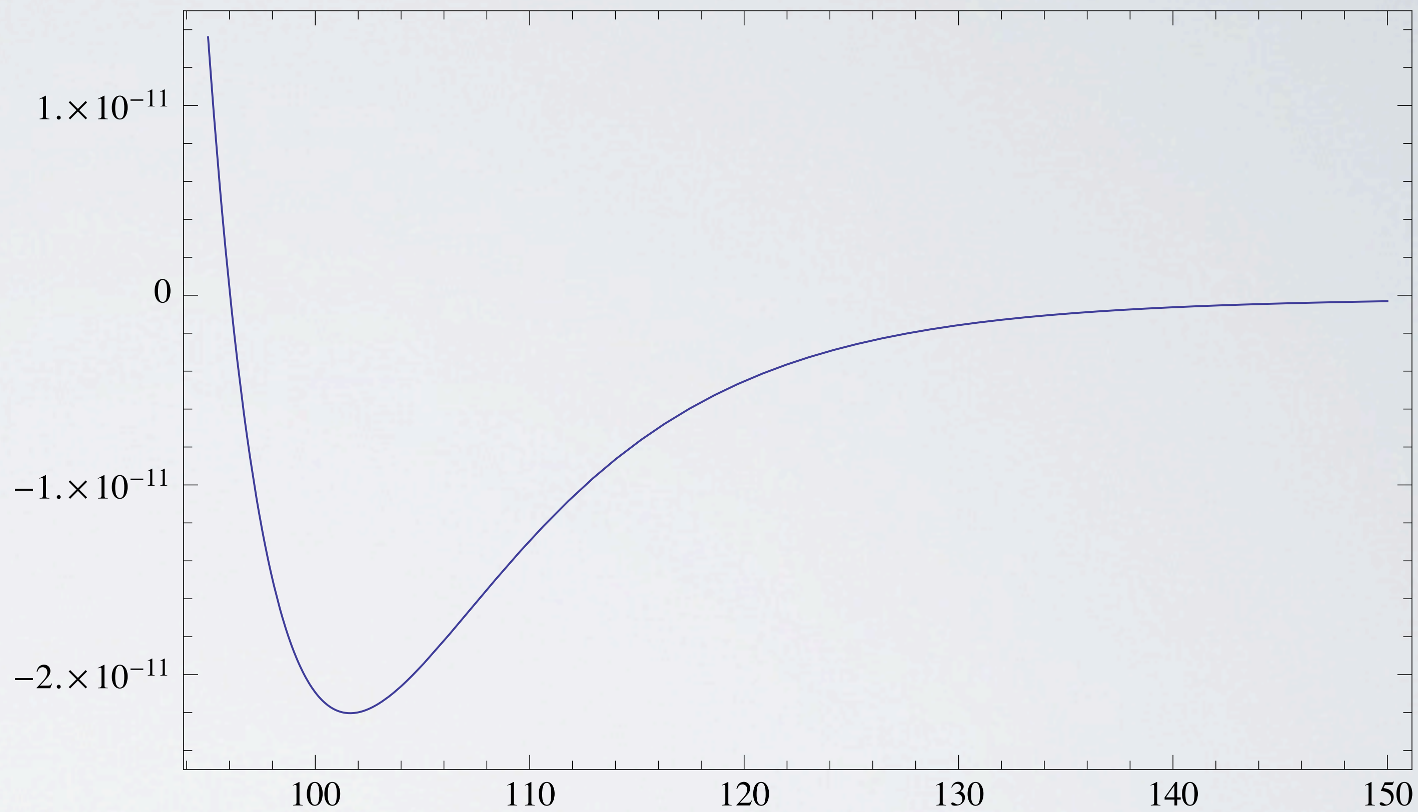

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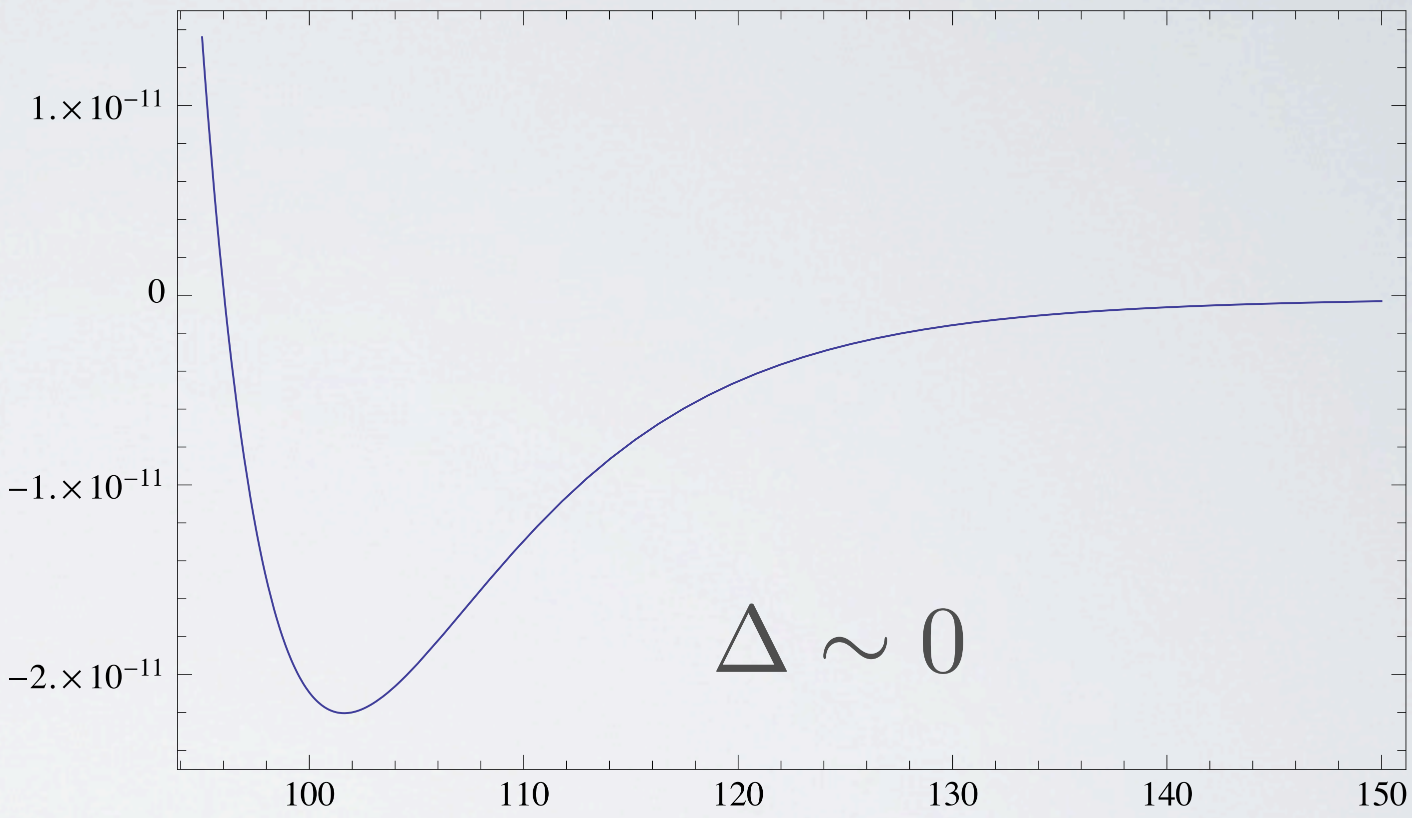

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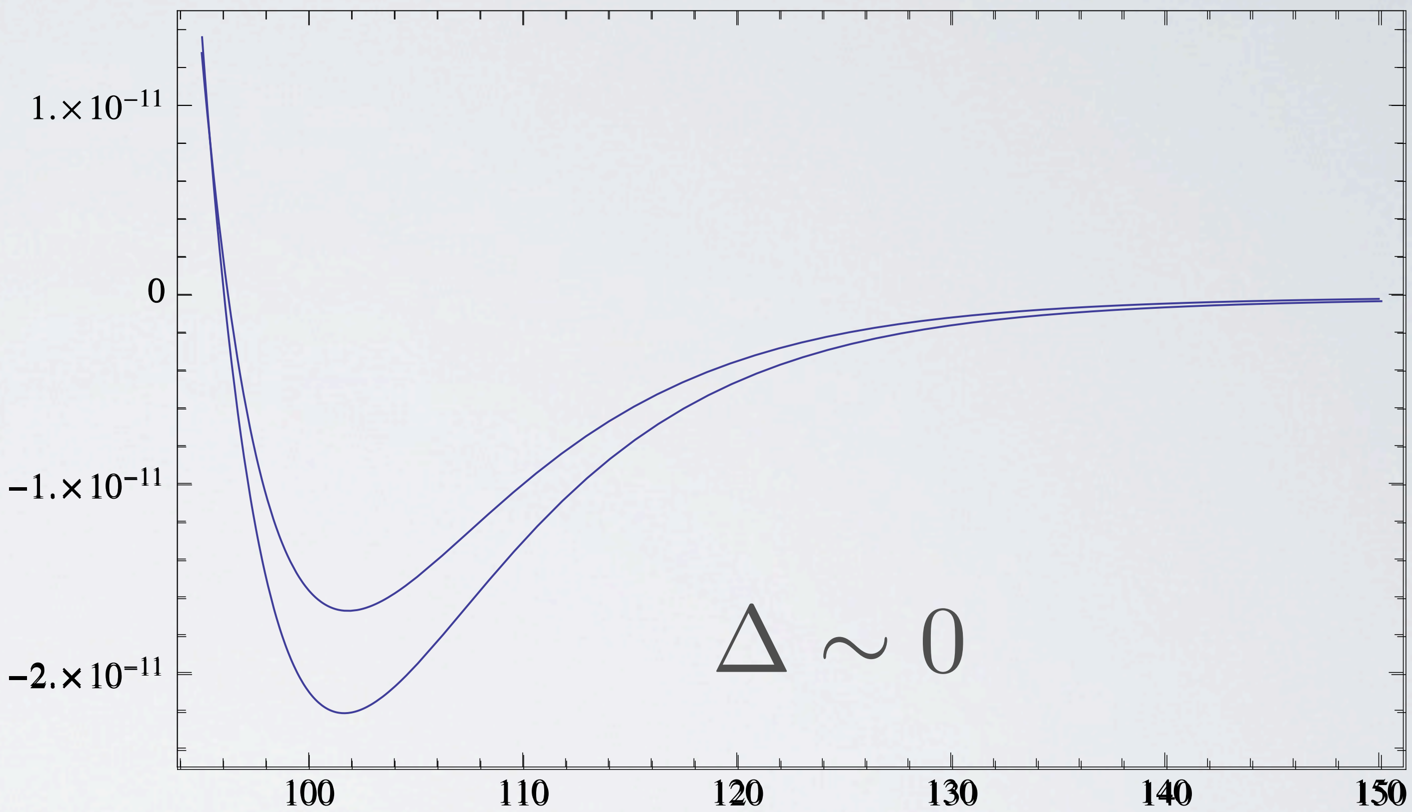

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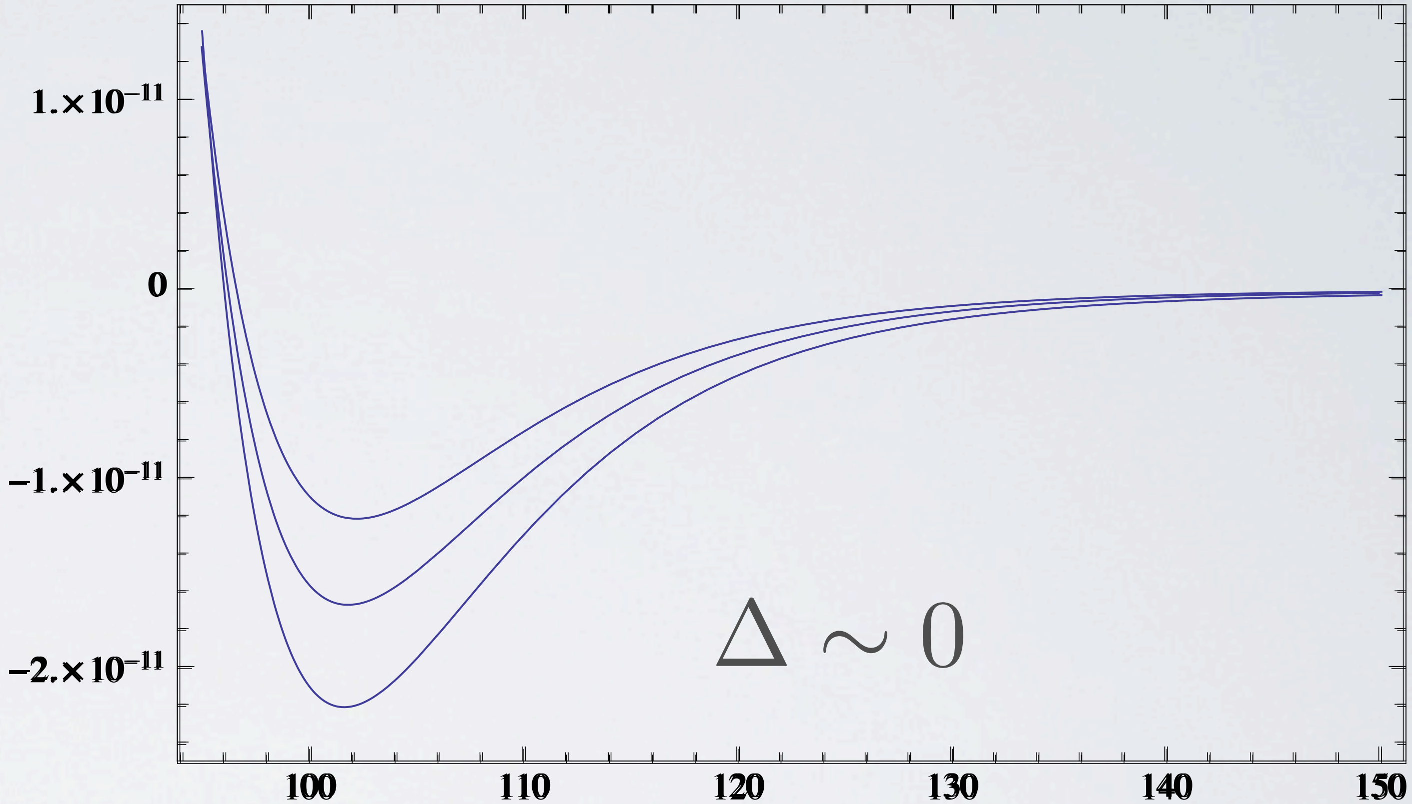

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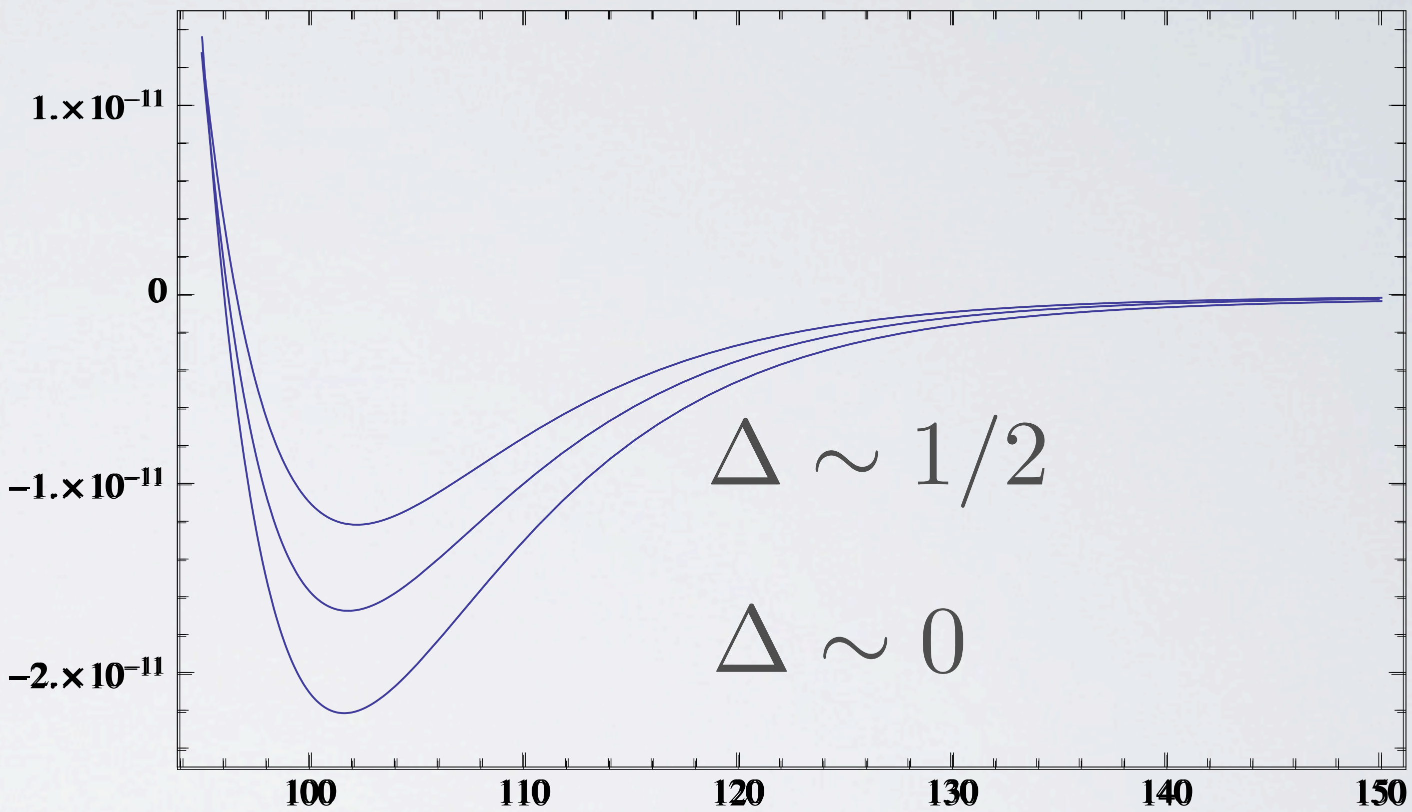

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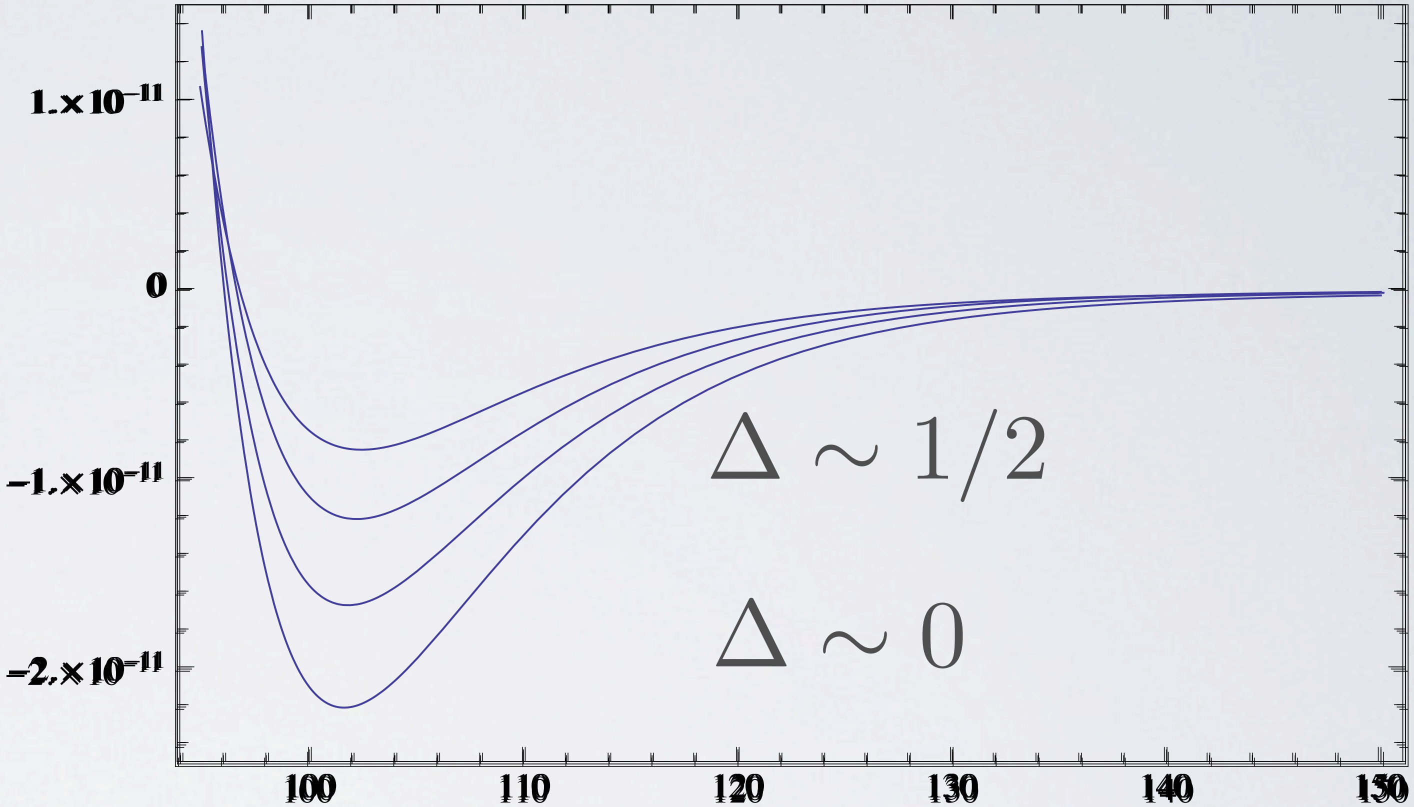

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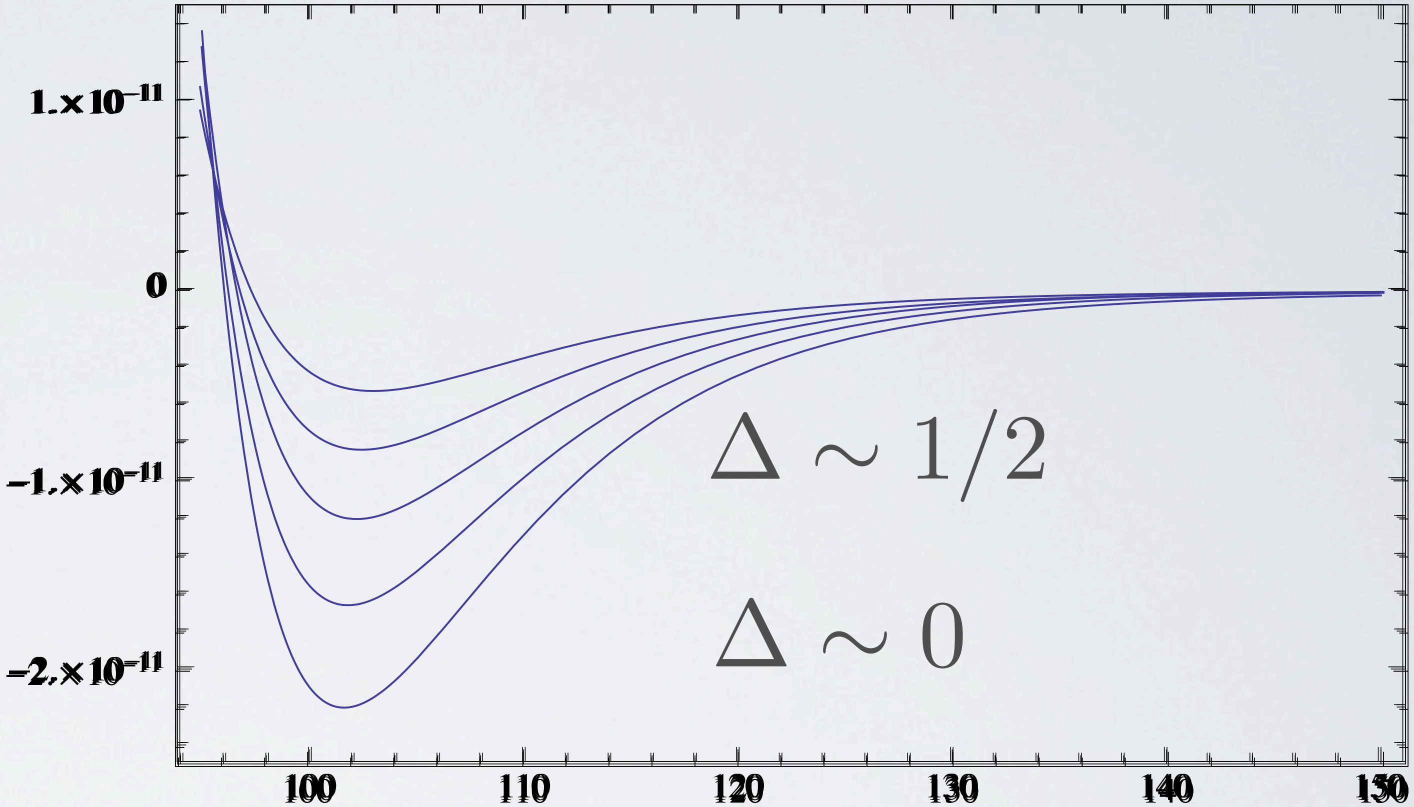

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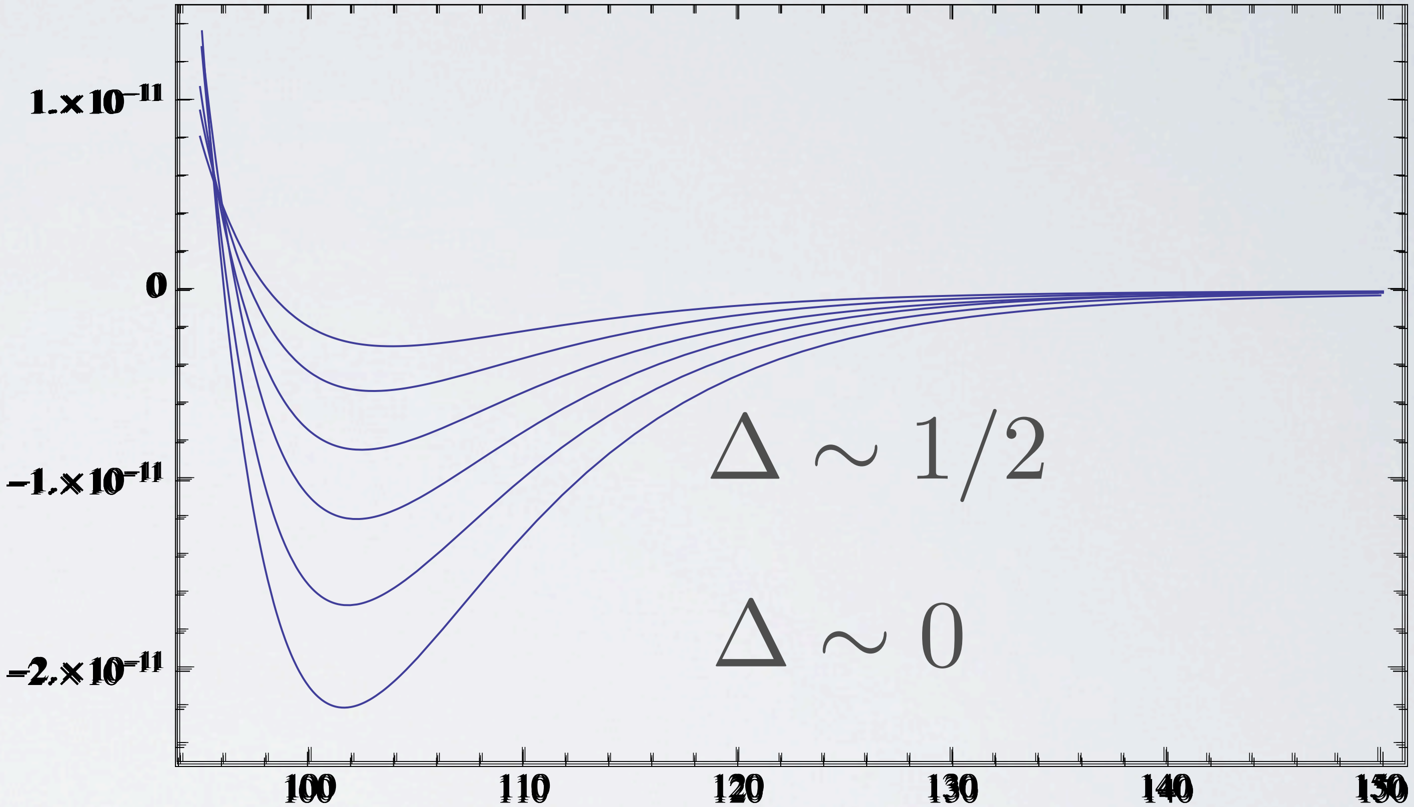

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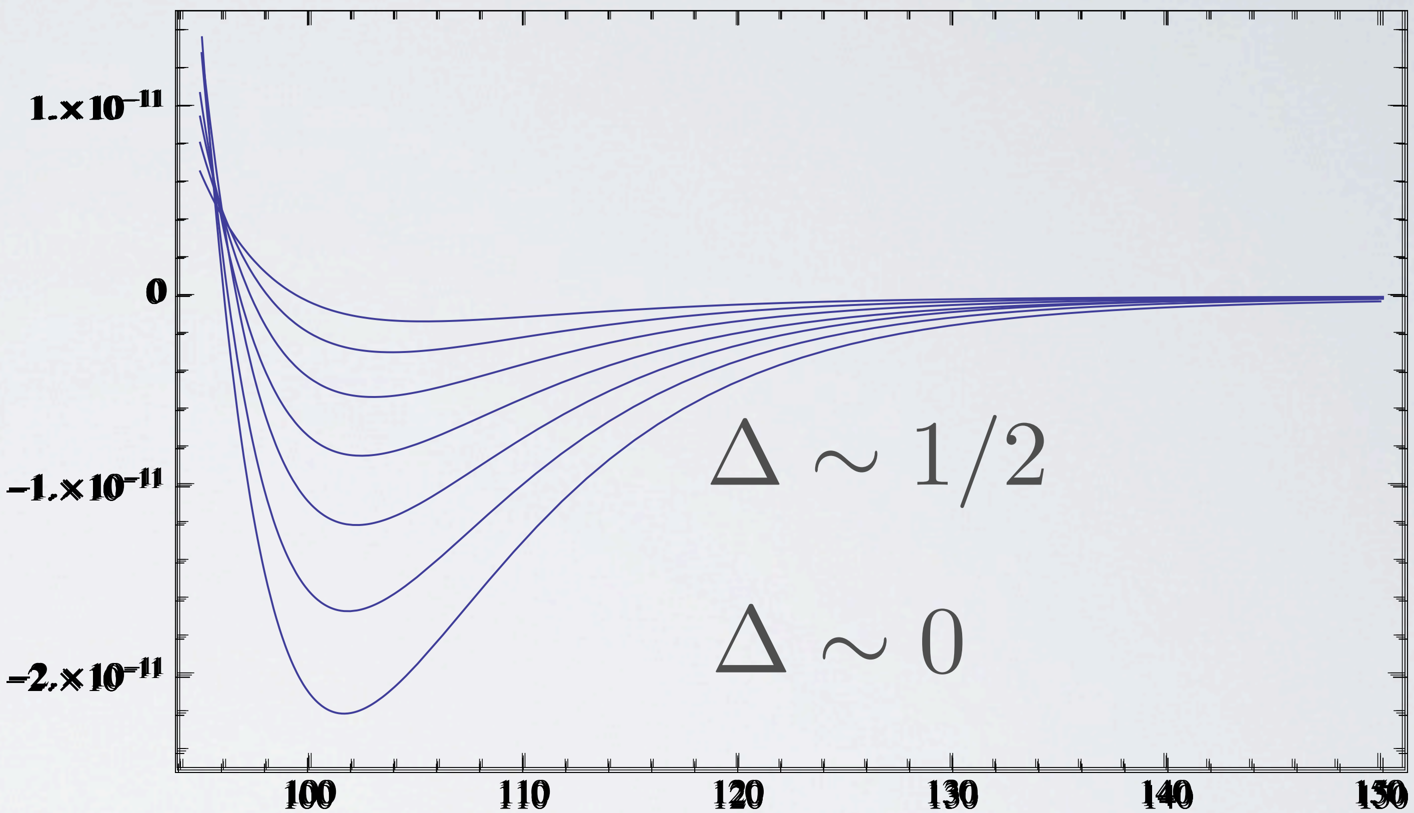

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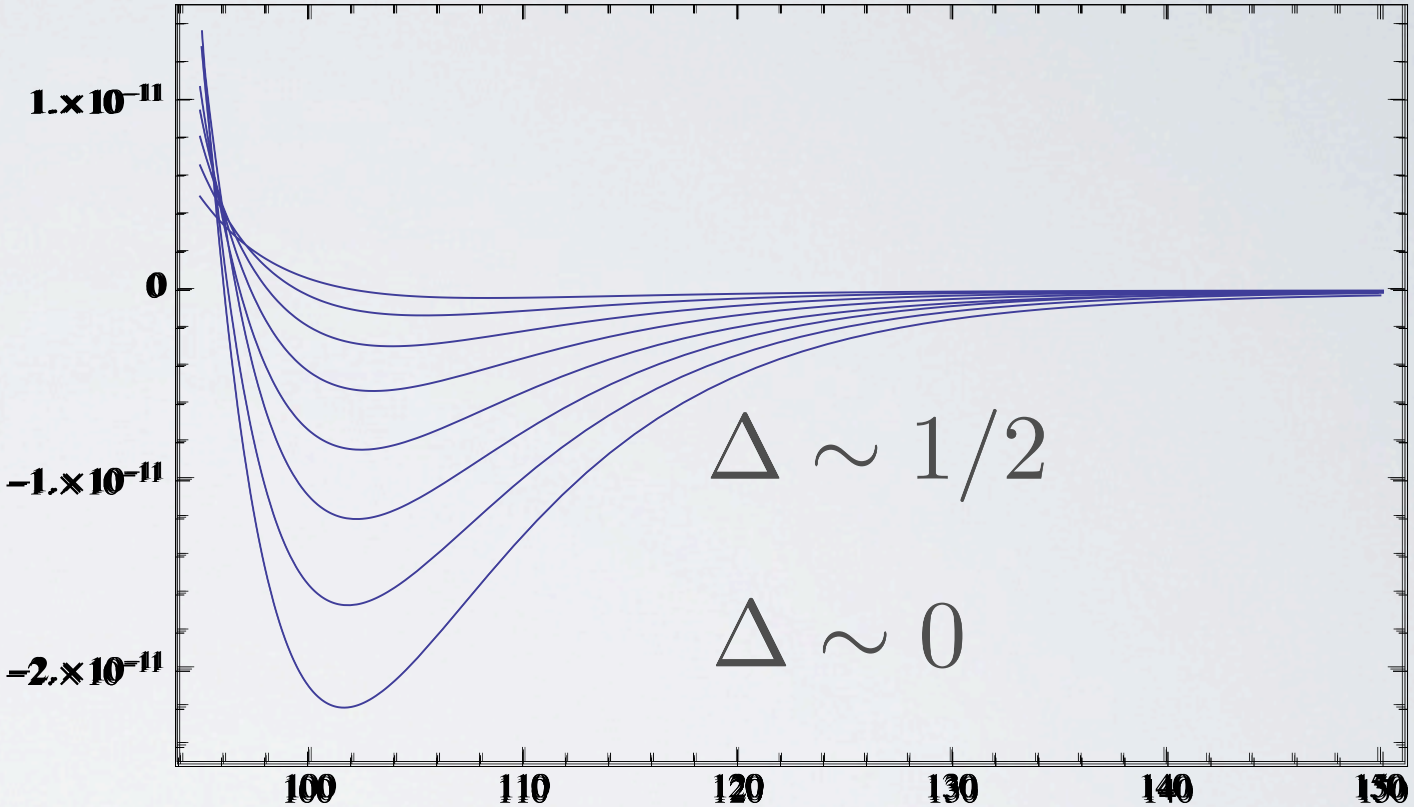

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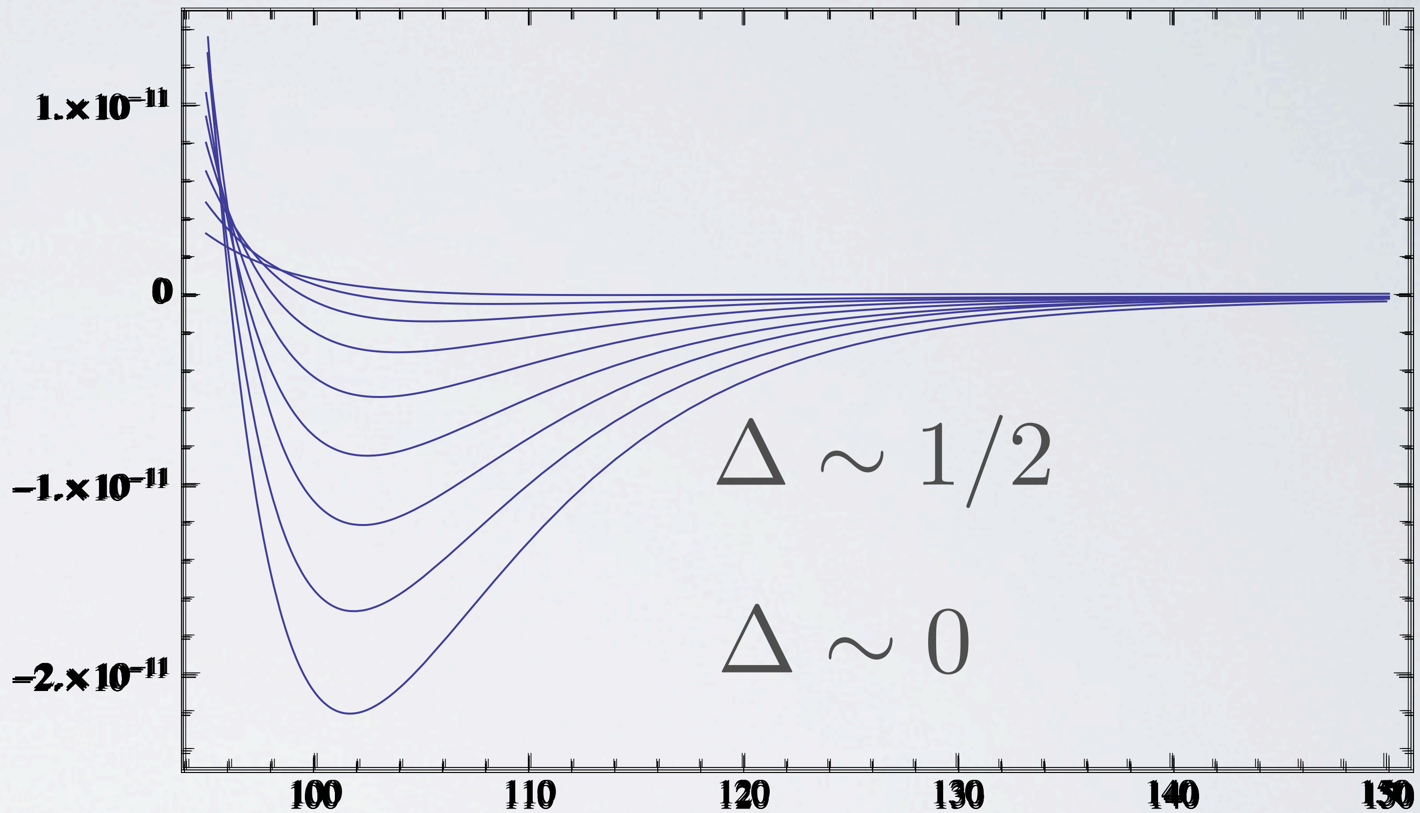

$$\delta V = -\frac{675k^4}{64}\frac{W_0^2}{\tau^5} + 45k^2\frac{A^2 a e^{-2a\tau}}{\tau^3} + 45k^2\frac{W_0 A a e^{-a\tau}}{\tau^3} + 15k^2\frac{A^2 a^2 e^{-2a\tau}}{2\tau^2}$$

$$\Delta = \langle \delta V / V_{KKLT} \rangle$$

KKLT stability

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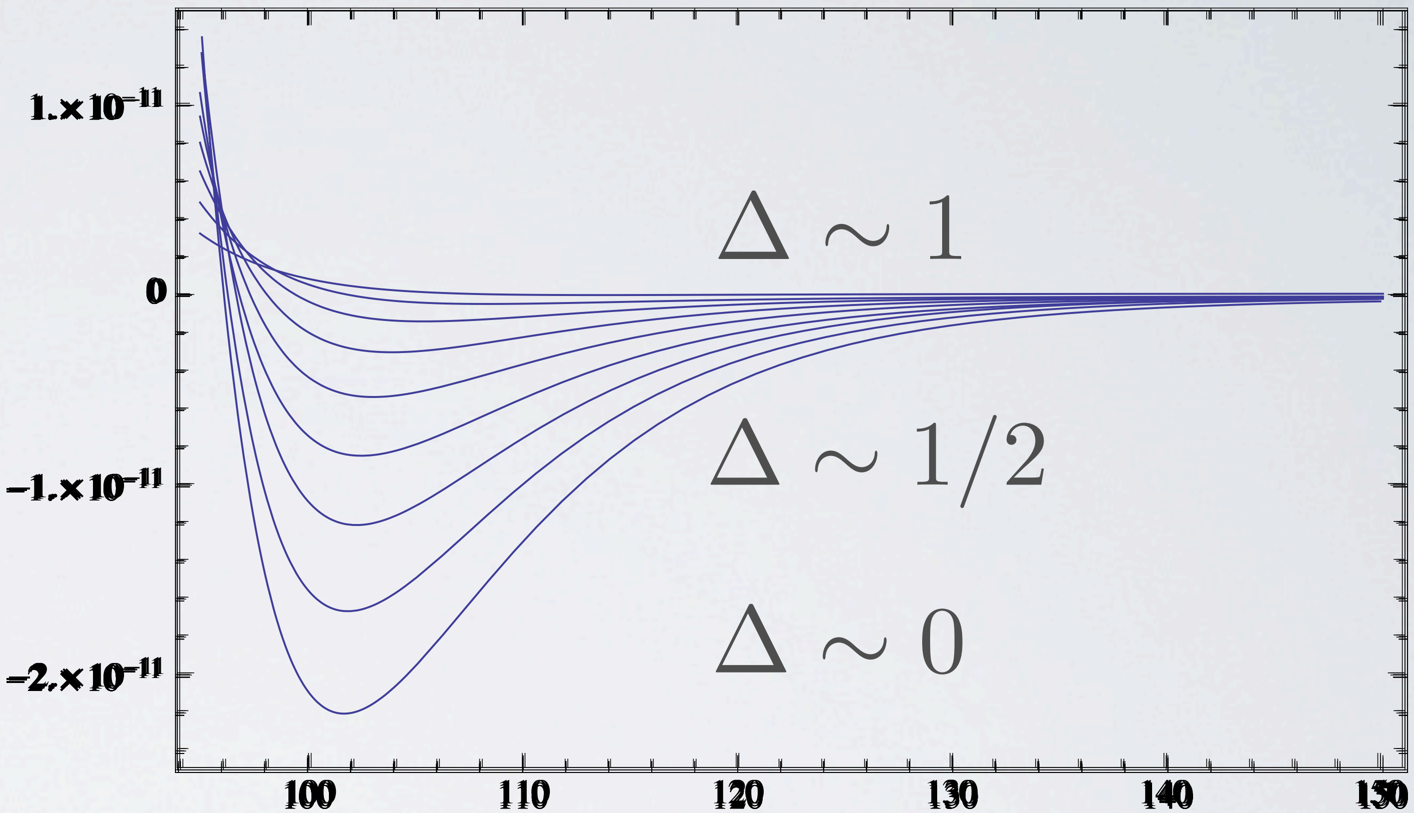

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Δ	$\langle\tau\rangle$	W_0
1	60	-10^{-3}
1/10	600	-10^{-25}
1/100	6000	-10^{-258}

LVS stability

LVS on $\mathbb{CP}^4_{11169}[18]$:

$$\mathcal{V} = \frac{1}{18}\tau_1^{3/2} - \frac{1}{9}\sqrt{2}\tau_2^{3/2}$$

$$\mathcal{V}_{O7\cap D7} = \frac{135}{8}\sqrt{\tau_1}$$

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$$\delta V_{(1,0)} + \delta V_{(2,0)} = -\frac{18225}{16}\left(\frac{3}{2}\right)^{1/3}\frac{W_0^2}{\mathcal{V}^{10/3}}$$

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$$\langle V_{LVS}\rangle \sim -\frac{\sqrt{\log\langle\mathcal{V}\rangle}}{6\sqrt{2}\,a^{3/2}\,\langle\mathcal{V}\rangle^3}|W_0|^2$$

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LVS vacuum only safe @ very large volumes:

- Tree level effect
- Large numerical coeffs.

Summary:

We have shown that:

- Explored stability of KKLT and LVS moduli stabilisation,
- Large coeffs. & no g_s suppression,
- Safety can be achieved @ large volumes,
- Impacts on KKLT/LVS phenomenology,